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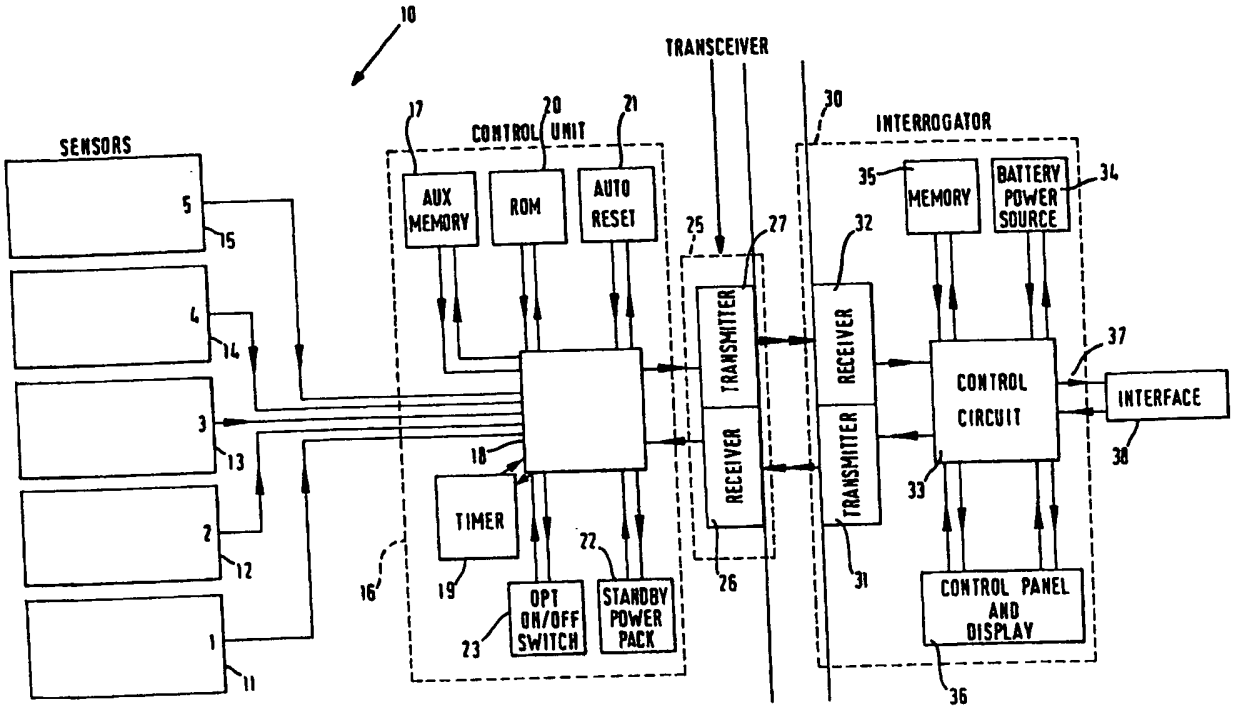
(54) Apparatus for determining the operational status of equipment

(57) An apparatus (10) for determining the operational status of equipment e.g. one of a plurality of street lamps, comprises a control means including a plurality of sensors (11–15) each sensing a respective operational parameter of the equipment, means (18) to detect when at least one of the sensors (11–15) senses a faulty operational parameter, means (25) to transmit a signal to a remote interrogator means (30) indicating the operational status of the equipment and where a single sensor (11–15) has sensed a faulty operational parameter, or where a plurality of sensors (11–15) have sensed faulty operational parameters, indicating the identity of at least one of said sensors which has sensed a faulty operational parameter.



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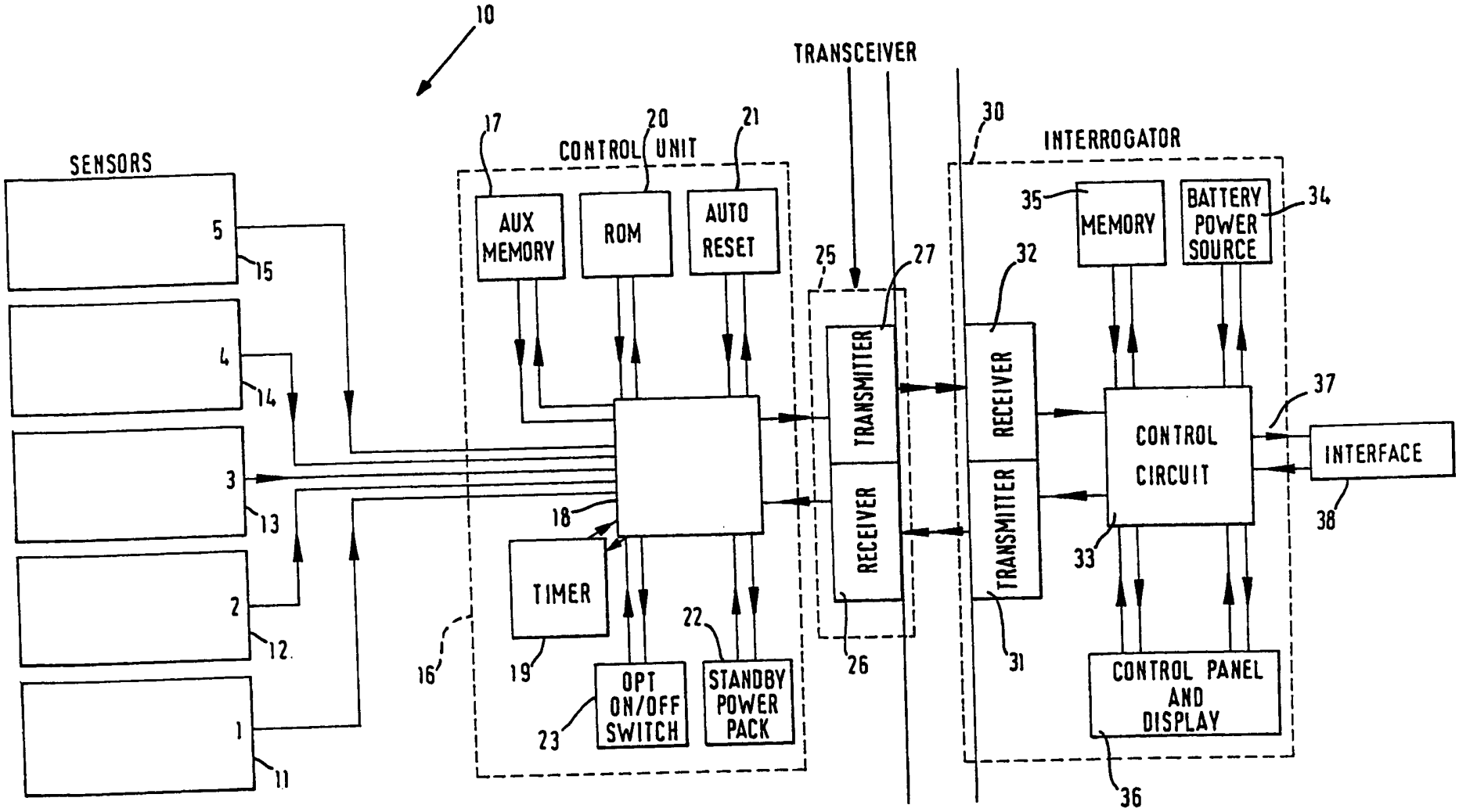
10
TRANSCEIVER
SENSORS
CONTROL UNIT
INTERROGATOR
17
20
21
30
5
15
4
14
3
13
2
12
1
11
AUX MEMORY
ROM
AUTO RESET
25
27
32
35
MEMORY
BATTERY POWER SOURCE
34
TRANSMITTER
RECEIVER
RECEIVER
TRANSMITTER
CONTROL CIRCUIT
37
INTERFACE
38
18
TIMER
16
19
22
OPT ON/OFF SWITCH
23
STANDBY POWER PACK
26
31
33
CONTROL PANEL AND DISPLAY
36

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SPECIFICATION

Apparatus for determining the operational status of equipment

This invention relates to an apparatus for determining the operational status of equipment and more particularly but not exclusively to an apparatus for determining the operational status of a street lamp.

Street lamps conventionally operate in response to a time switch and/or a light sensitive switch so that the street lamp is only switched on at night or in very dark daylight conditions. This means that to determine whether or not a particular street lamp is in a working operational condition, the lamp has to be inspected, usually at night.

When it has been ascertained that a particular street lamp is not in a working operative condition, further investigations have to be made during daylight hours, to determine the fault before a repair can be effected. If a component of the lamp needs replacing, this may entail a still further journey if the repairer does not have to hand, the replacement component.

Accordingly, it is an object of the present invention to provide a new or improved apparatus for determining the operational status of equipment.

According to a first aspect of the invention we provide an apparatus for determining the operational status of equipment comprising a control means including a plurality of sensors each sensing a respective operational parameter of the equipment, means to detect when at least one of the sensors senses a faulty operational parameter, means to transmit a signal to a remote interrogator means indicating the operational status of the equipment and where a single sensor has sensed a faulty operational parameter, indicating the identity of the sensor wich has sensed the faulty operational parameter, or where a plurality of sensors have sensed faulty operational parameters, indicating the identity of at least one of said sensors which has sensed a faulty operational parameter.

At least one of the sensors may sense the presence of absence of an electrical power supply to the equipment and/or another sensor may sense voltage or current at a selected position with the equipment and/or another sensor may comprise a light sensitive means to detect light which may be produced by the equipment. At least one of the sensors may operate in conjunction with a timer means and means may be provided to count a number of operational cycles within a given time period e.g. the number of times the equipment is switched on and off.

In each case, the sensors preferably each provide a signal to a control circuit which determines which, if any, of the sensors are sensing a faulty operational state. It will be appreciated that throughout this specification the term "signal" includes the disruption of an otherwise constant signal, a positive signal which is initiated only when the faulty operational state is sensed or a signal the magnitude of which changes a predetermined amount in response to a faulty operational state being sensed.

The control circuit may include a memory which stores information derived from the sensors.

The information stored preferably indicates which, if any, of the sensors have sensed a fault. Where more than one fault is sensed, for example, if a sensor senses a parameter which is dependant upon another parameter sensed by another sensor the information stored may indicate only that said another sensor has sensed a faulty condition, so that at least some of the sensors may have priority over other sensors.

The control means may have its own power supply or, where the equipment with which the apparatus is used is electrical equipment, the control means may be powered by the power supply to the equipment. Preferably though, in this latter case, a stand-by power supply is provided for use in the event that the power supply to the electrical equipment fails.

Where the equipment is one of a plurality of items of equipment each of which has sensors for sensing faulty operational states of the equipment, the control circuit of the apparatus may comprise a read only memory containing an identity indicator so that a single interrogator means may be used with said plurality of items of equipment.

The control circuit may be connected to a transmitter circuit which transmits a signal to the remote interrogator means. The transmitter circuit may transmit an electromagnetic wave such as visible light, a radio wave or a wave in the infra red or microwave regions of the spectrum or alternatively, the transmitter circuit may transmit an acoustic wave such as an ultrasonic wave. The signal may comprise a modulated or digitly encoded wave and where the signal is visible light, may emitted by a laser or other optical apparatus.

The control circuit may be connected to a receiver means whereby the interrogator means can signal the control means to transmit its signal, and the identity indicator where provided.

The interrogator means may comprise a receiver circuit to receive the signal transmitted from the transmitter of the control means, and the interrogator means may include a transmitter circuit to signal the transmitter of the control means to transmit the signal to the interrogator means.

The interrogator means preferably includes a control circuit with a memory to store infor-

mation derived from the control means.

Where a single interrogator means is used with a plurality of items of equipment, the memory of the interrogator means may store the identity indicator and the information concerning the operational state of the respective item of equipment.

In this case, preferably the interrogator means is portable and may be battery powered. For example, the interrogator means may comprise a hand-held unit which may have a control panel and a display to display the status of an item of equipment under interrogation.

The interrogator means is preferably adapted to be interfaced with a computer which may read the memory of the interrogator means and analyse the information obtained.

According to a second aspect of the invention we provide a lamp, including an apparatus for determining the operational state of the lamp according to the first aspect of the invention.

The lamp may be a street lamp such as is mounted on a lamp post e.g. above a public thoroughfare, an illuminated sign such as a traffic sign which may be mounted on a post or frame or on a building or in a bollard or any other lamp.

One of the sensors preferably senses whether electrical power is being supplied to the lamp from the mains electricity supply. For example, in a street lamp which is mounted on a lamp post, a fuse is usually provided which is the property and responsibility of the electricity supply board. Preferably the sensor is mounted adjacent the board fuse to detect whether electrical power is being supplied.

Another sensor may sense whether electrical power is present at a selected other position such as for example, adjacent a downstream fuse which is usually positioned in a street lamp, and is the responsibility of the public corporation having responsibility for operation of the lamp.

Another sensor may sense whether the time switch and/or light sensitive switch which operates the lamp, is in a correct working condition. This sensor may operate with a timer means of the control circuit to count how many times the lamp has been switched on and off within a 24 hour period. If the lamp is switched on more times than off this would indicate a faulty time switch and/or light sensitive means.

Another sensor may sense whether current is supplied to the lamp control gear such as a choke or starter circuit which is provided to facilitate initial illumination of the lamp.

Another sensor may sense whether light is being produced by the lamp.

Preferably one of each of these sensors is provided so that at least five sensors are provided in all. The control circuit may store a different signal in its memory, where provided, to indicate which of the sensors has sensed a faulty operational parameter. For example, where a first sensor senses that the power supply is not being provided to the mains board fuse, the memory of the control circuit may store this information as a numerical or alpha-numerical code within its memory. For example, this fault may be indicated by a binary number being stored in the memory.

If current is supplied to the mains board fuse but not to the downstream fuse, so that as second sensor senses a faulty operational parameter, another different binary number or alpha numerical code may be stored in the memory. Similarly, if a third sensor senses that the time switch or light sensitive switch is in a faulty operational state, another different binary number may be stored in the memory, Where the lamp control gear is sensed as being faulty so that a fourth sensor senses a fourth operational parameter, a still further different binary number may be stored in the memory and where a fifth sensor detects that the lamp is not illuminated, a yet still further different binary number may be stored in the memory.

Thus using this apparatus, an operator may inspect each of the street lamps in an area by simply interrogating the control means of the apparatus present on the lamp with the remote interrogator means. The operator may thus check which, if any, of the streets lamps are in a faulty operational condition. Furthermore due to the coding of the sensors, the operator will be able to determine the reason for the fault, i.e. which sensor is sensing a faulty operational parameter, which should facilitate the undertaking of repairs to the lamp.

Where the interrogator means has a memory, this memory may be simply downloaded at a later time to obtain all the information stored in the memory. The interrogator means may be adapted to be interfaced with a computer, in which case for example, a repair schedule can be drawn up by the computer indicating to a repairer the likely fault within a particular lamp as determined by the coding of the sensors within the lamp.

According to a third aspect of the invention we provide a system comprising a plurality of lamps, each lamp having at least one sensor sensing an operational parameter of the lamp, interrogator means remote from each of the lamps, each of the lamps having a control means including means to detect when said sensor senses a faulty operational state, and means to transmit a signal to the remote interrogator means indicating the opeational status of the equipment and identifying which of said lamps is in a faulty operational state.

Each lamp may comprise an item of equipment the operational status of which is determined by an apparatus according to the first aspect of the invention and/or may comprise

a lamp in accordance with the second aspect of the invention.

The invention will now be described with the aid of the accompanying drawing which shows diagrammatically an apparatus in accordance with the invention.

Referring to the drawing, an apparatus 10 for determining the operational state of equipment comprising a street lamp of the type comprising a lamp mounted on a lamp post, is shown. Five sensors 11–15 each sense a respective operational perameter of the street lamp and are connected to a control circuit 16.

Sensor 11 is an electrical power sensor and is positioned downstream of a fuse usually located within the lamp post which is the property and responsibility of the mains electricity supply board. If power is present, i.e. there is electrical continuity across the fuse, sensor 11 provides an output. If power is absent, indicating a fault, e.g. a blown fuse, the sensor 11 provides no output which is interpreted by the control circuit 16 to provide a "message" which is stored in a memory 17 thereof as a binary coded number "1" i.e. 1. Thus sensor 11 senses the operational condition of the mains board fuse of the lamp.

Of course, if required, this may be reversed so that an output from sensor 11 is provided when no electrical power is sensed, and the control circuit, if suitably programmed would recognise this output and provide the "message" to the memory 17 to indicate a faulty operational condition.

Sensor 12 is again an electrical power sensor but is positioned downstream of a further fuse provided usually located within the lamp post which further fuse is the property and responsibility of the public corporation or area board. If power is present, i.e. there is electrical continuity across the area board fuse, the sensor 12 again provides an output although if power is absent, the sensor 12 provides no output, which signal which is interpreted by the control circuit 16 and stored in memory 17 as a binary coded number "1 0" i.e. 2. If however, the memory 16 already contains binary coded number "1" indicating that no power is being sensed by sensor 11, the output from sensor 12 will be ignored. Again, sensor 12 may alternatively be arranged to provide an output when no power is sensed.

Thus sensor 12 senses the condition of the area board fuse.

Sensor 13 senses the operational condition of the time switch and/or light sensitive means whichever is provided, to ensure that the lamp is switched on at night, and where the light sensitive means is provided, in very dark daylight conditions.

Some street lamps have both time switches and light sensitive means, in which case sensor 13 senses the operational condition of stream of the switch and/or light sensitive means and provides a pulse to the control circuit 16 each time the lamp is switched on or off. The control circuit includes timer means 19 whereby a sensor 13 is able to check whether the lamp is switched on and off an equal number of times in every 24 hour period. Thus the number of operational cycles of the street lamp are sensed. If the time switch and/or light sensitive means fails usually the lamp remains switched on, and thus an unequal number of ons and offs will be sensed. The control circuit 16 thus stores information in the memory 17 as the binary number "1 1" i.e. 3. However, if the memory 17 already contains the binary number "1" indicating that no power is being supplied, or "1 0" indicating that the area board fuse is faulty, the output from sensor 13 will be ignored. Thus if the memory contains the binary number "1 1" this can only mean that the time switch/light sensitive means is at fault.

Sensor 14 is a voltage sensor and is positioned downstream of the lamp control gear e.g. a starter circuit of the lamp.

In the event that the sensor 14 senses an insufficient voltage developed by the starter circuit to start the lamp, the sensor 14 will provide an output which is interpreted by the control circuit 16 and stored in memory 17 as the binary number "1 0 0" i.e. 4 but not if memory 17 already contains binary number "1" or "1 0" or "1 1" in which case the output from sensor 14 will be ignored. Thus if memory 17 contains the binary number "1 1 0" this can only mean that there is a fault in the operational status of the lamp control gear.

Again sensor 14 may alternatively be arranged to provide no output when insufficient voltage is sensed, which signal may be interpreted by the control circuit where a microprocessor 18 thereof is suitable programmed.

Finally, sensor 15 is a light sensitive sensor and is positioned adjacent the lamp bulb to detect whether the lamp is illuminated or not. In the event that the lamp is not illuminated, indicating a faulty bulb, then an output is provided to the control circuit 16 which is interpreted and stored in memory 17 as the binary number "1 0 1" i.e. 5 but not if memory 17 already contains binary number "1" or "1 0" or "1 1" or "1 0 0". Thus if the memory 17 contains binary number "1 0 1" this can only mean that there is a fault with the lamp bulb. Again, the sensor 15 may be arranged to provide no output when insufficient light is sensed, to signal the control circuit 16 that the bulb is faulty.

The sensors 11–15 preferably sense their respective operational parameters continuously. However when the lamp is normally switched off, at least the sensors 11,12,14 and 15 are deactivated.

This may be achieved by the control circuit

16 ignoring any signal received from the sensors during normal "off" periods, which may be signalled to the control circuit either from the internal timer means 19, or from the time switch/light sensitive switch which controls the on/off function of the lamp. However as described below, when the control circuit 16 is interrogated, during daylight hours when the lamp is normally switched off, the sensors 11,12,14 and 15 may be activated, as the lamp may be remotely switched on to provide a test.

Whether the lamp is switched on or off, preferably the memory 17 is arranged to retain the information fed to it by sensors 11 to 15 indicating a faulty operational condition until a repair has been effected.

The control circuit 16 comprises a programmed microprocessor 18 to which the outputs from sensors 11 to 15 are fed, and to which memory 17 and timer 19 are connected. A further memory 20 is provided of the read-only type, which memory 20 contains a unique identity indicator in the form of an alpha, alphanumeric, or numerical code, for a reason hereinafter described. Further, the control circuit 16 comprises a "reset" circuit 21 to enable the memory 17 to be cleared once any fault in the lamp has been rectified. This may be operated manually once a repair has been effected, or automatically once a fault is no longer being sensed.

The control circuit 16 is powered from the electrical supply to the lamp, but has a standby power pack 22 (preferably of the rechargeable battery type) which automatically comes into use should the mains supply fail. The control circuit 16 could alternatively be battery powered although the former arrangement is preferred as this requires minimal maintenance.

Finally, the control circuit 16 has a circuit 23 sensitive to a command transmitted thereto from an interrogator means 30 hereinafter described, to enable the lamp to be switched on remotely, which circuit 23 would be arranged to override the time switch and/or light sensitive switch within the lamp.

The control circuit 16 is connected by a cable to a remote transceiver 25 which includes a receiver circuit 26 to receive incoming infrared digitally encoded signals, and a transmitter circuit 27 to transmit information from memories 17 and 20, again as an infrared digitally encoded signal.

The transceiver 25 is preferably mounted in a clear position on the lamp post to facilitate communication with the interrogator means 30 which also has a transmitter circuit 31 to transmit digitally encoded infrared signals, and a receiver circuit 32 to receive digitally encoded infrared signals. Preferably the transmitters 27 and 31, and receivers 26 and 32 are sufficiently powered that they may be spaced for up to 30 metres without any risk of a faulty transmission.

The interrogator means 30 further comprises a control circuit 33 connected to the transmitter 31 and receiver 32, the circuit 33 preferably comprising a programmed microprocessor.

The interrogator means 30 is preferably a portable device of the hand-held type which is battery powered from a battery power source 34 and has a memory 35 of the programmable type to receive information transmitted from the tranceiver 25 on the lamp post.

A control panel and digital display unit 36 is included. The interrogator means 30 has an output means 37 which is adapted to co-operate with a suitable interface 38 of a computer so that the information stored in the memory 35 of the interrogator means 30 can be downloaded onto a computer which may then analyse the information as required.

The memory 35 of the interrogator means 30 is preferably of sufficiently large capacity to store information from a plurality of street lamps simultaneously. This a single interrogator means 30 may be used to interrogate a plurality of street lamps each having sensors, a control circuit, and transceiver, as hereinbefore described. The status of each street lamp is given by way of the binary code stored in the memory 17, and the lamp to which the status refers, is identified by the unique identity indicator stored in the read-only memory 20.

Operation of the apparatus will now be described.

The interrogator means 30 is pointed at the transceiver 25 on the lamp post and a signal is sent by pressing a "on/switching" key on the control panel 36 of the interrogator means 30. This signal will activate the switching circuit 23 of the control circuit 16 so that the lamp will be switched on. This will also activate the sensors 11,12,14,15, which are arranged to sense only when the lamp is switched on, either by the remote interrogator means 30 or by the normal time switch/light sensitive switch.

Another "on/transmit" key of the control panel 36 when pressed, will then cause the information stored in memories 17 and 20 to be transmitted to the interrogator means 30. The status of the street lamp i.e. the binary number stored in memory 17 will be indicated on the display 36. If no binary number is stored in memory 17 (or binary number "0") indicating that the street lamp is in an operative condition, the display may be cancelled by pressing a "cancel" key on the control panel 36. Alternatively, if the display indicates that there is a fault in the street lamp, the display may be saved by pressing a "save" key on the control panel 36 which causes the information to be fed to memory 35 along with the unique identity indicator for the lamp. Pressing of either the "cancel" or "save"

keys will render the interrogator means 30 ready for the next test to be carried out on the next street lamp.

When all the information stored in the memories 17 and 20 has been transmitted to the interrogator means 30, the transceiver 25 will be switched off by the circuit 23 although the memory 17 will retain its binary code indicating the fault in the street lamp.

When the operator has returned to base, all of the information stored in memory 35 of the interrogator means 30 may be downloaded into a computer by connection of the output means 37 with an interface 38 of the computer.

The computer may analyse the information and for example prepare a work schedule and/
or a list of any replacement components which may be required to rectify the fault in the street lamps. Thus the operator may return to the the or each faulty street lamp during daylight hours and effect repairs. When the repairs have been effected on each lamp, the reset circuit 21 is actuated manually (but could be arranged to be actuated automatically) to clear memory 17 so that the memory 17 will again contain no binary number (or binary number "0"), thus indicating that the street lamp is in a working operational condition.

Various modifications may be made to the apparatus described without departing from the scope of the invention. Particularly, instead of the signals between the control circuit 16 and interrogator means 30 being transmitted by way of a digitly encoded infrared signal, a radio wave, modulated light signal or any other electromagnetic wave, or even an ultrasonic wave could be used as a transmitting medium.

The features of the control circuit 16 and interrogator means 30 described, may of course be changed where alternative features are required, for example where the apparatus is used with alternative equipment to a street lamp.

Where the operational status of only one street lamp or other equipment is to be sensed, so that a unique identifier would not be required, the read-only memory 20 may be omitted.

Although the invention has been described with reference to equipment comprising a street lamp, such a system for maintaining a watch and sensing the status of equipment may be applied to any other piece of equipment having a plurality of operational parameters sensed by sensors which provide an input to a control circuit indicating the status of the equipment.

The features disclosed in the foregoing description, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function or a method or process for attaining the disclosed result, or a class or group of substances or compositions, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. An apparatus for determining the operational status of equipment comprising a control means including a plurality of sensors each sensing a respective operational parameter of the equipment, means to detect when at least one of the sensors senses a faulty operational parameter, means to transmit a signal to a remote interrogator means indicating the operational status of the equipment and where a single sensor has sensed a faulty operational parameter, indicating the identity of the sensor which has sensed the faulty operational parameter, or where a plurality of sensors have sensed faulty operational parameters, indicating the identity of at least one of said sensors which has sensed a faulty operational parameter.

2. An apparatus according to claim 1 wherein at least one of the sensors senses the presence or absence of an electrical power supply to the equipment.

3. An apparatus according to claim 1 or claim 2 wherein a sensor senses voltage or current at a selected position within the equipment.

4. An apparatus according to claim 1 or claim 2 or claim 3 wherein a sensor comprises a light sensitve means to detect light which may be produced by the equipment.

5. An apparatus according to any one of claims 1 to 4 wherein a plurality of sensors are provided and at least one of the sensors operates in conjunction with a timer means.

6. An apparatus according to claim 5 wherein means are provided to count a number of operational cycles within a given time period.

7. An apparatus according to claim 5 or claim 6 wherein the sensors each provide a signal to a control circuit which determines which, if any, of the sensors are sensing a faulty operational state.

8. An apparatus according to claim 7 wherein the control circuit includes a memory which stores information derived from the sensors.

9. An apparatus according to claim 8 wherein the information stored indicates which, if any, of the sensors have sensed a fault.

10. An apparatus according to claim 9 wherein where more than one fault is sensed, the information stored indicates only that one sensor has sensed a faulty condition, at least some of the sensors having priority over other sensors.

11. An apparatus according to any one of

claims 7 to 10 wherein the control means has its own power supply.

12. An apparatus according to any one of claims 7 to 10 wherein where the equipment with which the apparatus is used is electrical equipment, and the control means is powered by the power supply to the equipment.

13. An apparatus according to claim 12 wherein a stand-by power supply is provided for use in the event that the power supply to the electrical equipment fails.

14. An apparatus according to any one of claims 7 to 13 wherein the equipment with which the apparatus is used is one of a plurality of items of equipment each of which has sensors for sensing faulty operational states of the equipment, the control circuit of the apparatus comprising a read only memory containing an identity indicator so that a single interrogator means may be used with said plurality of items of equipment.

15. An apparatus according to any one of claims 7 to 14 wherein the control circuit is connected to a transmitter circuit which transmits a signal to the remote interrogator means.

16. An apparatus according to claim 15 wherein the transmitter circuit transmits an electromagnetic wave.

17. An apparatus according to claim 15 wherein the transmitter circuit transmits an acoustic wave.

18. An apparatus according to claim 16 or claim 17 wherein the signal comprises a modulated or digitly encoded wave.

19. An apparatus according to claim 16 wherein the electromagnetic wave is visible light, emitted by an optical apparatus of the transmitter circuit.

20. An apparatus according to any one of claims 7 to 19 wherein the control circuit is connected to a receiver means whereby the interrogator means can signal the control means to transmit its signal, and the identity indicator where provided.

21. An apparatus according to any one of the preceding claims wherein the interrogator means comprises a receiver circuit to receive the signal transmitted from the transmitter circuit of the control means.

22. An apparatus according to any one of the preceding claims wherein the interrogator means includes a transmitter circuit to signal the transmitter of the control means to transmit the signal to the interrogator means.

23. An apparatus according to any one of the preceding claims wherein the interrogator means includes a control circuit with a memory to store information derived from the control means.

24. An apparatus according to claim 23 where appendant to claim 14 wherein the memory of the interrogator means stores the identity indicator and the information concerning the operational state of the equipment.

25. An apparatus according to any one of the preceding claims wherein the interrogator means is portable and battery powered.

26. Apparatus according to claim 25 wherein the interrogator means comprises a hand-held unit with a control panel and a display to display the status of equipment under interrogation.

27. An apparatus substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

28. A lamp, including an apparatus for determining the operational state of the lamp according to any one of claims 1 to 27.

29. A lamp according to claim 28 which is a street lamp to light a public thoroughfare, or an illuminated sign.

30. A lamp according to claim 28 or claim 29 having a sensor to sense whether electrical power is being supplied to the lamp from the mains electricity supply.

31. A lamp according to claim 30 wherein another sensor is provided to sense whether electrical power is present adjacent a downstream fuse.

32. A lamp according to claim 30 or claim 31 wherein another sensor is provided to sense whether a time switch and/or light sensitive switch which operates the lamp, is in a working condition.

33. A lamp according to claim 32 wherein this sensor operates with a timer means of the control circuit to count how many times the lamp has been switched on and off within a 24 hour period.

34. A lamp according to any one of claims 30 to 33 wherein another sensor is provided to sense whether current is supplied to a choke or starter circuit of the lamp.

35. A lamp according to any one of claims 30 to 34 wherein another sensor is provided to sense whether light is being produced by the lamp.

36. A lamp according to claim 28 or claim 29 which has fine sensors as specified individually in claims 30, 31, 33, 34 and 35.

37. A lamp according to claim 36 where appendant to claim 7 wherein the control circuit stores a different signal in its memory, to indicate which of the sensors has sensed a faulty operational perameter.

38. A lamp substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

39. A system comprising a plurality of lamps, each lamp having at least one sensor sensing an operational parameter of the lamp, interrogator means remote from each of the lamps, each of the lamps having a control means including means to detect when said sensor senses a faulty operational state, and means to transmit a signal to the remote interrogator means indicating the operational status of the equipment and identifying which of said lamps is in a faulty operational state.

40. A system according to claim 39 wherein each lamp comprises an item of equipment the operational status of which is determined by an apparatus according to any one of claims 1 to 27.

41. A system according to claim 39 or claim 40 wherein each lamp of the system comprises a lamp according to any one of claims 28 to 38.

42. A system substantially as hereinbefore described with reference to the accompanying drawings.

43. Any novel feature or novel combination of features disclosed herein and/or shown in the accompanying drawings.

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